

Evaluating the Health of the Tidal Potomac River Watershed

Tumor Surveys in Brown Bullhead Catfish

The Potomac — An American Heritage River

The Potomac River, designated as an American Heritage River, rivals the mighty Hudson and Mississippi Rivers for its importance in American history. The Potomac basin contains the first evidence of inhabited structures in North America, the homes of Paleo Indians who inhabited the Shenandoah Valley some 12,000 years ago. In modern times, the basin has been a passage to the west, a boundary between North and South during the Civil War, home of the Nation's Capital, and a gathering place for all Americans. The tidal section of the river extends from just upstream of Washington, D.C. to the mouth at Point Lookout on the Chesapeake Bay.

Its watershed offers a wealth of recreational activities and is rich in wildlife. The U.S. Fish and Wildlife Service's Potomac River National Wildlife Refuge (NWR) Complex, located about 25 miles down river of Washington, D.C., provides a variety of habitats that support migratory birds, fish, reptiles, amphibians, and mammals.

Protecting the Nation's Fish & Wildlife

The Service conserves, protects, and enhances fish and wildlife and their habitats for the continuing benefit of the American people. One way this is accomplished is through the Environmental Contaminants Program which identifies and prevents harmful contaminant effects on fish and wildlife and restores resources degraded by contaminants. Environmental Contaminants staff at the Chesapeake Bay Field Office serve Maryland, Delaware, Virginia, and the District of Columbia. This region supports thousands of fish and

wildlife species and is home to millions of people.

Environmental contaminant investigations take place on and off Service lands such as National Wildlife Refuges. Often we evaluate the health of fish as indicators of

environmental quality. In one such study we identified Neabsco Creek, a Virginia tidal tributary of the Potomac River that borders the Featherstone National Wildlife Refuge portion of the Potomac River NWR Complex, as an area of concern.

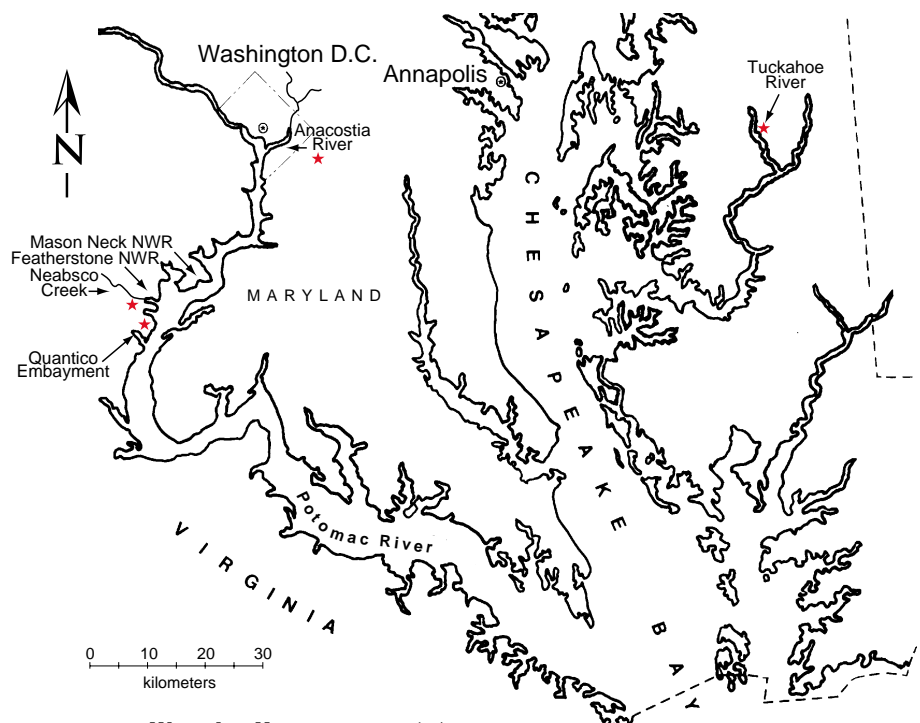


Figure 1. Bullhead collection sites (★)

Figure 2. Anacostia River at CSX railroad bridge; this urban tributary was designated a Region of Concern by the Chesapeake Bay Program.



The Problem

In 1995, we reported that, in brown bullhead (*Ameiurus nebulosus*) catfish collected from Neabsco Creek, there was a 10% prevalence of liver tumors and a 33% prevalence of skin tumors. This type of catfish has been used for tumor surveys for many years, especially in the Great Lakes. It feeds on the bottom and buries in the mud over the winter, thus increasing its exposure to contaminated sediments. Brown bullheads are believed to have a relatively small home range. Its susceptibility to tumors and life history make it a good indicator of habitat quality.

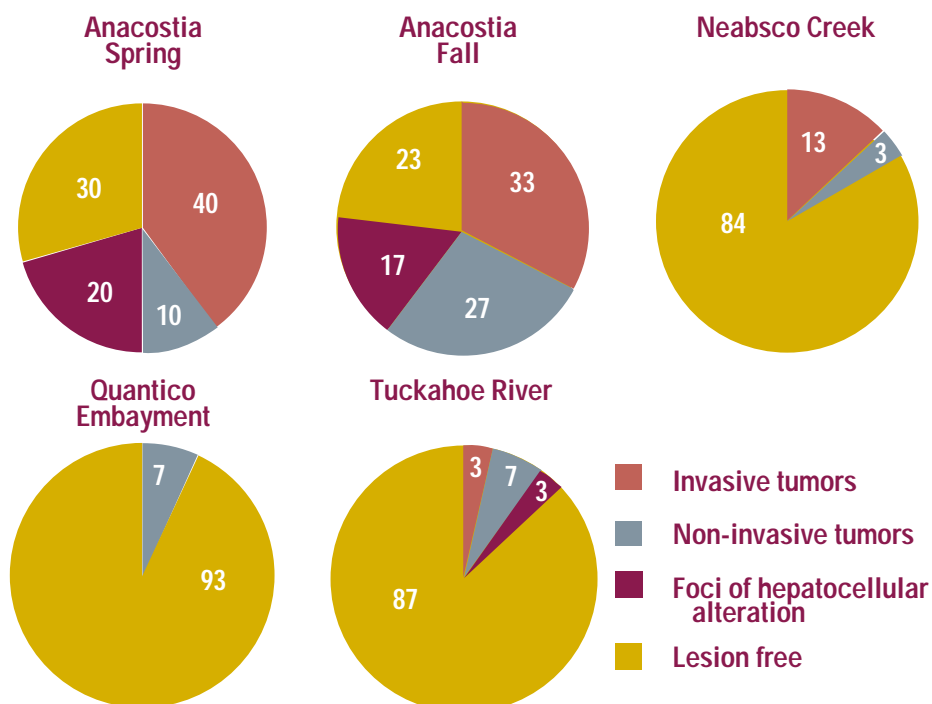
In 1996, Environmental Contaminant specialists launched a broader scale investigation of the health of this catfish species in the tidal Potomac watershed. The results of this study are now available in the report, Tumor Prevalence and Biomarkers of Exposure and Response in Brown Bullheads (*Ameiurus nebulosus*) from the Tidal Potomac River Watershed.

Figure 4. Brown bullhead from the Anacostia River with 2.1 x 1.3 cm firm red lesion on lower lip and dental ridge diagnosed as a skin cancer.



Figure 3.

Percentage of brown bullheads with various types of liver lesions



The Study

Thirty age 3 or older brown bullheads from Neabsco Creek, the Anacostia River near the CSX Railroad Bridge (in spring and fall), and the Quantico embayment were collected (Fig.1). The Anacostia River (Fig. 2) is one of three Regions of Concern in the Chesapeake Bay identified by the U.S. Environmental Protection Agency. It is currently the focus of a multi-agency effort aimed at identifying contaminant sources and reducing their impacts. The Quantico embayment borders an EPA Superfund hazardous waste site that is being cleaned up. Thirty brown bullheads were also collected from the Tuckahoe River on the Eastern Shore of Maryland as a reference. The fish were dissected and detailed tissue studies (histopathology) were run on the livers and all visible skin lesions. Some fish were also randomly selected for laboratory analysis of contaminant concentrations in fillets and for biochemical analysis of the livers.

What Was Found

Fifty percent of the spring collection and 60% of the fall collection from the Anacostia River had liver tumors, more than half of which were classified as invasive tumors. From Neabsco Creek, 17% of the fish had liver tumors, 13% of these were invasive (Figs. 3, 5, 6). Skin tumors (Fig. 4, 7) were also high in Anacostia River fish – 37% in the spring and 10% in the fall. Only 3% of the Neabsco Creek fish had skin tumors. Biochemical and chemical tests on the fish and sediments from the collection sites suggest that exposure to PAHs, identified as carcinogens in laboratory tests, may be responsible for the tumors. PAHs are found in petroleum, coal, and other fossil fuels and the heavier, more carcinogenic compounds are byproducts from burning these fuels. PAHs enter rivers through runoff from roads and storm sewers, through spills, and from the atmosphere.

What This Means

Based on Great Lakes data, it is believed that liver tumor rates above 9% and skin tumor rates above 20% are nearly always found in fish from contaminated areas. The rates in the Anacostia River fish are similar to those reported in highly contaminated areas. The liver tumor rate in the Neabsco Creek fish also warrants concern. Further studies are needed to determine if the tumors affect the fish populations.

Continuing Activities

The Service, along with the University of Maryland Eastern Shore, is studying the movements of brown bullheads to determine if the fish collected from the Anacostia River are resident to that tributary or are moving in and out of the Potomac. The Service is also working with other federal agencies, Maryland and Virginia environmental departments, District of Columbia government, and local

groups to identify the sources and effects of pollutants in the Anacostia and tidal Potomac and determine appropriate cleanup measures.

Recommendations

Tumor surveys should be used as a tool to monitor areas of the Chesapeake Bay with contaminated sediments. Such surveys should be conducted before and after sediments are cleaned up or the sources of contamination are controlled.

Tumor Prevalence and Biomarkers of Exposure and Response in Brown Bullheads (Ameiurus nebulosus) from the Tidal Potomac River Watershed. Pinkney A. E., J. C. Harshbarger, E. B. May, and M. J. Melancon, 2000. CBFO-C99-04. U.S. Fish and Wildlife Service, Chesapeake Bay Field Office, 177 Admiral Cochrane Drive, Annapolis, MD 21401. Reports and fact sheets can be downloaded from the CBFO web site: www.fws.gov/r5cbfo

Figure 5. Liver cancer: Cancerous cells (A) have expanded into normal liver tissue (B) containing exocrine pancreas (C).

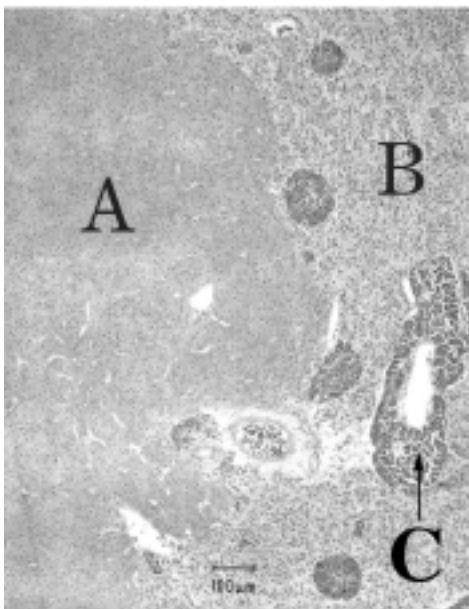


Figure 6. Biliary cancer: Neoplastic bile ducts (A) entrapping normal liver tissue (B).

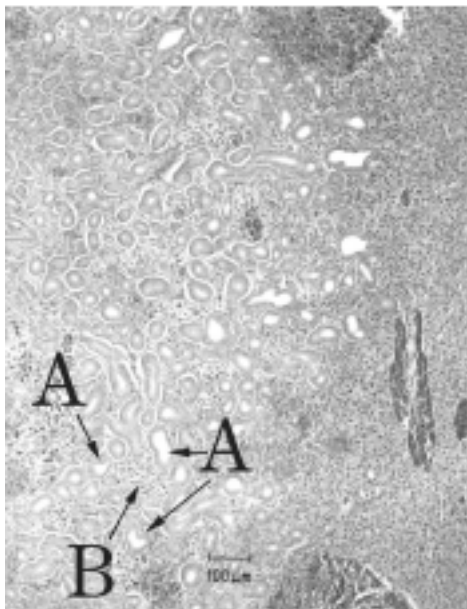
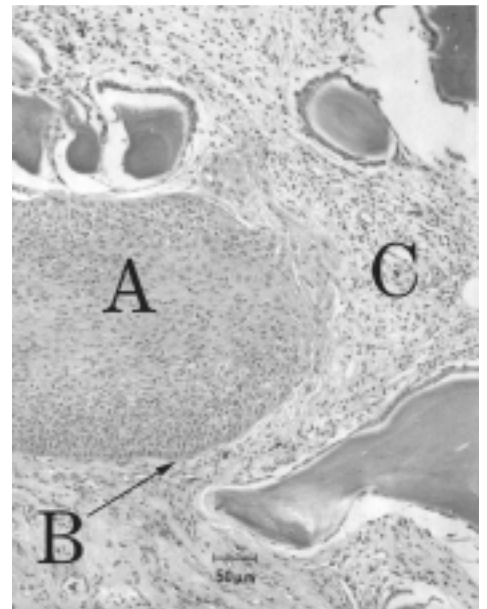


Figure 7. Skin cancer: A peg of neoplastic epithelium (A) from the lip breached the basal cell layer (B) and invaded the connective tissue.



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